

THAT WHICH IS CLAIMED IS:

1. A method of communicating with a plurality of application instances executing on a cluster of data processing systems having a plurality of communication protocol stacks associated therewith utilizing a single Internet Protocol (IP) address, the method comprising the steps of:

establishing a first of the plurality of communication protocol stacks as a routing communication protocol stack associated with the single IP address;

defining ones of the plurality of communication protocol stacks which are associated with the single IP address as candidate target communication protocol stacks;

distributing among the plurality of communication protocol stacks an identification of protocol stacks which are associated with the single IP address and an identification of the routing communication protocol stack;

notifying the routing communication protocol stack when an instance of the plurality of application instances associated with a candidate target communication protocol stack listens to a port of the single IP address so as to define the candidate target communication protocol stack as a current actual target stack;

receiving a request to establish a connection to the single IP address and the port of the single IP address;

establishing a routing table entry corresponding to the current actual target stack responsive to receiving a request to establish a connection to the single IP address and the port so as to define a routing path associated with the IP address and the port from the

routing communication protocol stack to the current
actual target stack; and

5 routing communications for the connection to the
port of the IP address received by the routing
communication protocol stack based on the routing table.

10 2. A method according to Claim 1, wherein the step
of defining ones of the plurality of communication
protocol stacks which are associated with the single IP
address as candidate target communication protocol stacks
comprises the step of defining all of the plurality of
communication protocol stacks of the cluster of data
processing systems as candidate target communication
protocol stacks.

15 3. A method according to Claim 1, wherein the step
of defining ones of the plurality of communication
protocol stacks which are associated with the single IP
address as candidate target communication protocol stacks
20 comprises the step of defining enumerated ones of the
plurality of communication protocol stacks of the cluster
of data processing systems as candidate target
communication protocol stacks.

25 4. A method according to Claim 1, wherein the step
of establishing a first of the plurality of communication
protocol stacks as a routing communication protocol stack
associated with the single IP address comprises the step
of establishing a first of the plurality of communication
30 protocol stacks as a routing communication protocol stack
associated with the single IP address for routing
communications associated with at least one specified
port associated with the IP address;

35 wherein the step of defining ones of the plurality
of communication protocol stacks which are associated

with the single IP address as candidate target
communication protocol stacks comprises the step of
defining ones of the plurality of communication protocol
stacks which are associated with the at least one
5 specified port associated with the IP address as
candidate target communication protocol stacks;

wherein the step of defining ones of the plurality
of communication protocol stacks which are associated
with the single IP address as candidate target

10 communication protocol stacks comprises the step of
distributing among the plurality of communication
protocol stacks an identification of protocol stacks
which are associated with the at least one port of the
single IP address as candidate target communication
15 protocol stacks and an identification of the routing
communication protocol stack; and

wherein the step of notifying the routing
communication protocol stack when an instance of the
plurality of application instances associated with a
20 candidate target communication protocol stack listens to
a port of the single IP address so as to define the
candidate target communication protocol stack as a
current actual target stack comprises the step of
notifying the routing communication protocol stack when
25 an instance of the plurality of application instances
associated with a candidate target communication protocol
stack listens to the at least one port of the single IP
address so as to define a current actual target stack.

30 5. A method according to Claim 4, wherein the at
least one port comprises a plurality of ports identified
in a port list associated with the single IP address.

6. A method according to Claim 4, wherein the at least one port comprises all ports associated with the single IP address.

5 7. A method according to Claim 1, further comprising:

notifying the routing communication protocol stack that the instance of the plurality of application instances associated with the candidate target communication protocol stack has terminated listening to the port of the single IP address; and

10 removing the routing table entry corresponding to the candidate target communication protocol stack so as to remove the routing path associated with the IP address, the port and the candidate target communication protocol stack.

15 8. A method according to Claim 7, wherein the step of notifying the routing communication protocol stack that the instance of the plurality of application instances associated with the candidate target communication protocol stack has terminated listening to the port of the single IP address comprises the step of sending a termination message through a cross coupling facility of the cluster of data processing systems.

20 9. A method according to Claim 1, wherein the steps of establishing a first of the plurality of communication protocol stacks as a routing communication protocol stack associated with the single IP address and defining ones of the plurality of communication protocol stacks which are associated with the single IP address comprise the step of incorporating a VIPADISTribute statement in a VIPADynamic definition block associated with the first communication protocol stack, wherein the

VIPADISTRIBUTE statement defines an IP address as a dynamic routable virtual IP address (VIPA), identifies ports associated with the VIPA which are routable, and identifies communication protocols stacks associated with the VIPA.

10. A method according to Claim 9, wherein the step of distributing among the plurality of communication protocol stacks an identification of protocol stacks which are associated with the single IP address and an identification of the routing communication protocol stack comprises broadcasting a list including the definitions of the VIPADISTRIBUTE statement.

11. A method according to Claim 1, further comprising the steps of:

notifying the routing communication protocol stack that a connection utilizing the single IP address and the port of the single IP address has terminated; and

removing the routing table entry corresponding to the connection to the current actual target stack so as to remove the routing path associated with the IP address, the port and the current actual target stack.

12. A method according to Claim 1, wherein the step of establishing a routing table entry is preceded by the step of selecting a current actual target stack so as to provide a selected communication protocol stack associated with the connection request; and

wherein the step of establishing a routing table entry corresponding to the current actual target stack responsive to receiving a request to establish a connection to the single IP address and the port so as to define a routing path associated with the IP address and the port from the routing communication protocol stack to

the current actual target stack comprises the step of establishing a routing table entry corresponding to the selected communication protocol stack associated with the connection request to provide a routing path associated with the IP address and the port from the routing communication protocol stack to the selected communication protocol stack.

13. A system for communicating with a plurality of application instances executing on a cluster of data processing systems having a plurality of communication protocol stacks associated therewith utilizing a single Internet Protocol (IP) address, comprising:

a routing communication protocol stack configured to receive communications to the single IP address and to forward to the received communications to a selected communication protocol stack from the plurality of communication protocol stacks;

a destination port table associated with the routing communication protocol stack which identifies communication protocol stacks having application instances bound to the single IP address and listening to a predefined port of the single IP address; and

a current routing table associated with the routing communication protocol stack which identifies routing paths from the routing communication protocol stack to a communication protocol stack associated with a connection utilizing the single IP address and the predefined port.

14. A system according to Claim 13, wherein the routing communication protocol stack is further configured to build the destination port table based on status messages received from communication protocol stacks of the plurality of communication protocol stacks having application instances bound to the single IP

18. A system according to Claim 13, wherein the predefined port comprises a plurality of predefined ports identified in a port list associated with the single IP address.

19. A system according to Claim 13, wherein the predefined port comprises all ports associated with the single IP address.

20. A system for communicating with a plurality of application instances executing on a cluster of data processing systems having a plurality of communication protocol stacks associated therewith utilizing a single Internet Protocol (IP) address, comprising:

means for establishing a first of the plurality of communication protocol stacks as a routing communication protocol stack associated with the single IP address;

means for defining ones of the plurality of communication protocol stacks which are associated with the single IP address as candidate target communication protocol stacks;

means for distributing among the plurality of communication protocol stacks an identification of protocol stacks which are associated with the single IP address and an identification of the routing communication protocol stack;

means for notifying the routing communication protocol stack when an instance of the plurality of application instances associated with a candidate target communication protocol stack listens to a port of the single IP address so as to define the candidate target communication protocol stack as a current actual target stack;

means for receiving a request to establish a connection to the single IP address and the port of the single IP address;

means for establishing a routing table entry corresponding to the current actual target stack responsive to receiving a request to establish a connection to the single IP address and the port so as to define a routing path associated with the IP address and the port from the routing communication protocol stack to the current actual target stack; and

means for routing communications for the connection to the port of the IP address received by the routing communication protocol stack based on the routing table.

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~~21~~. A system according to Claim ¹³~~20~~, wherein the means for defining ones of the plurality of communication protocol stacks which are associated with the single IP address as candidate target communication protocol stacks comprises means for defining all of the plurality of communication protocol stacks of the cluster of data processing systems as candidate target communication protocol stacks.

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~~22~~. A system according to Claim ¹³~~20~~, wherein the means for defining ones of the plurality of communication protocol stacks which are associated with the single IP address as candidate target communication protocol stacks comprises means for defining enumerated ones of the plurality of communication protocol stacks of the cluster of data processing systems as candidate target communication protocol stacks.

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~~23~~. A system according to Claim ¹³~~20~~, wherein the means for establishing a first of the plurality of communication protocol stacks as a routing communication

protocol stack associated with the single IP address
comprises means for establishing a first of the plurality
of communication protocol stacks as a routing
communication protocol stack associated with the single
5 IP address for routing communications associated with at
least one specified port associated with the IP address;

wherein the means for defining ones of the plurality
of communication protocol stacks which are associated
with the single IP address as candidate target
10 communication protocol stacks comprises means for
defining ones of the plurality of communication protocol
stacks which are associated with the at least one
specified port associated with the IP address as
candidate target communication protocol stacks;

15 wherein the means for defining ones of the plurality
of communication protocol stacks which are associated
with the single IP address as candidate target
communication protocol stacks comprises means for
distributing among the plurality of communication
20 protocol stacks an identification of protocol stacks
which are associated with the at least one port of the
single IP address as candidate target communication
protocol stacks and an identification of the routing
communication protocol stack; and

25 wherein the means for notifying the routing
communication protocol stack when an instance of the
plurality of application instances associated with a
candidate target communication protocol stack listens to
a port of the single IP address so as to define the
30 candidate target communication protocol stack as a
current actual target stack comprises means for notifying
the routing communication protocol stack when an instance
of the plurality of application instances associated with
a candidate target communication protocol stack listens

to the at least one port of the single IP address so as to define a current actual target stack.

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24. A system according to Claim 16, wherein the at
5 least one port comprises a plurality of ports identified
in a port list associated with the single IP address.

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25. A system according to Claim 16, wherein the at
10 least one port comprises all ports associated with the
single IP address.

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26. A system according to Claim 13, further
comprising:

means for notifying the routing communication
15 protocol stack that the instance of the plurality of
application instances associated with the candidate
target communication protocol stack has terminated
listening to the port of the single IP address; and

means for removing the routing table entry
20 corresponding to the candidate target communication
protocol stack so as to remove the routing path
associated with the IP address, the port and the
candidate target communication protocol stack.

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27. A system according to Claim 19, wherein the
25 means for notifying the routing communication protocol
stack that the instance of the plurality of application
instances associated with the candidate target
communication protocol stack has terminated listening to
30 the port of the single IP address comprises means for
sending a termination message through a cross coupling
facility of the cluster of data processing systems.

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28. A system according to Claim 13, wherein the
35 means for establishing a first of the plurality of

communication protocol stacks as a routing communication
protocol stack associated with the single IP address and
the means for defining ones of the plurality of
communication protocol stacks which are associated with
5 the single IP address comprise means for incorporating a
VIPADISTribute statement in a VIPADynamic definition
block associated with the first communication protocol
stack, wherein the VIPADISTribute statement defines an IP
address as a dynamic routable virtual IP address (VIPA),
10 identifies ports associated with the VIPA which are
routable, and identifies communication protocols stacks
associated with the VIPA.

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25. A system according to Claim 21, wherein the
15 means for distributing among the plurality of
communication protocol stacks an identification of
protocol stacks which are associated with the single IP
address and an identification of the routing
communication protocol stack comprises means for
20 broadcasting a list including the definitions of the
VIPADISTribute statement.

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30. A system according to Claim 20, further
comprising:

25 means for notifying the routing communication
protocol stack that a connection utilizing the single IP
address and the port of the single IP address has
terminated; and

means for removing the routing table entry
30 corresponding to the connection to the current actual
target stack so as to remove the routing path associated
with the IP address, the port and the current actual
target stack.

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A system according to Claim 13, further comprising means for selecting a current actual target stack so as to provide a selected communication protocol stack associated with the connection request; and

5 wherein the means for establishing a routing table entry corresponding to the current actual target stack responsive to receiving a request to establish a connection to the single IP address and the port so as to define a routing path associated with the IP address and
10 the port from the routing communication protocol stack to the current actual target stack comprises means for establishing a routing table entry corresponding to the selected communication protocol stack associated with the connection request to provide a routing path associated
15 with the IP address and the port from the routing communication protocol stack to the selected communication protocol stack..

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A computer program product for communicating
20 with a plurality of application instances executing on a cluster of data processing systems having a plurality of communication protocol stacks associated therewith utilizing a single Internet Protocol (IP) address, comprising:

25 a computer readable storage medium having computer readable program code embodied therein, the computer readable program code comprising:

computer readable program code which establishes a
first of the plurality of communication protocol stacks
30 as a routing communication protocol stack associated with the single IP address;

computer readable program code which defines ones of
the plurality of communication protocol stacks which are
associated with the single IP address as candidate target
35 communication protocol stacks;

computer readable program code which distributes among the plurality of communication protocol stacks an identification of protocol stacks which are associated with the single IP address and an identification of the routing communication protocol stack;

computer readable program code which notifies the routing communication protocol stack when an instance of the plurality of application instances associated with a candidate target communication protocol stack listens to a port of the single IP address so as to define the candidate target communication protocol stack as a current actual target stack;

computer readable program code which receives a request to establish a connection to the single IP address and the port of the single IP address;

computer readable program code which establishes a routing table entry corresponding to the current actual target stack responsive to receiving a request to establish a connection to the single IP address and the port so as to define a routing path associated with the IP address and the port from the routing communication protocol stack to the current actual target stack; and

computer readable program code which routes communications for the connection to the port of the IP address received by the routing communication protocol stack based on the routing table.

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23. A computer program product according to Claim 25, wherein the computer readable program code which defines ones of the plurality of communication protocol stacks which are associated with the single IP address as candidate target communication protocol stacks comprises computer readable program code which defines all of the plurality of communication protocol stacks of the cluster

of data processing systems as candidate target communication protocol stacks.

5 ³⁵~~32~~ ²⁷~~34~~. A computer program product according to Claim
defines ones of the plurality of communication protocol
stacks which are associated with the single IP address as
candidate target communication protocol stacks comprises
computer readable program code which defines enumerated
10 ones of the plurality of communication protocol stacks of
the cluster of data processing systems as candidate
target communication protocol stacks.

15 ³⁵~~32~~ ²⁸~~35~~. A computer program product according to Claim
establishes a first of the plurality of communication
protocol stacks as a routing communication protocol stack
associated with the single IP address comprises computer
readable program code which establishes a first of the
20 plurality of communication protocol stacks as a routing
communication protocol stack associated with the single
IP address for routing communications associated with at
least one specified port associated with the IP address;
wherein the computer readable program code which
25 defines ones of the plurality of communication protocol
stacks which are associated with the single IP address as
candidate target communication protocol stacks comprises
computer readable program code which defines ones of the
plurality of communication protocol stacks which are
30 associated with the at least one specified port
associated with the IP address as candidate target
communication protocol stacks;
wherein the computer readable program code which
defines ones of the plurality of communication protocol
35 stacks which are associated with the single IP address as

candidate target communication protocol stacks comprises computer readable program code which distributes among the plurality of communication protocol stacks an identification of protocol stacks which are associated with the at least one port of the single IP address as candidate target communication protocol stacks and an identification of the routing communication protocol stack; and

wherein the computer readable program code which notifies the routing communication protocol stack when an instance of the plurality of application instances associated with a candidate target communication protocol stack listens to a port of the single IP address so as to define the candidate target communication protocol stack as a current actual target stack comprises computer readable program code which notifies the routing communication protocol stack when an instance of the plurality of application instances associated with a candidate target communication protocol stack listens to the at least one port of the single IP address so as to define a current actual target stack.

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~~28~~ ²⁶. A computer program product according to Claim ~~25~~, wherein the at least one port comprises a plurality of ports identified in a port list associated with the single IP address.

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~~28~~ ²⁷. A computer program product according to Claim ~~25~~, wherein the at least one port comprises all ports associated with the single IP address.

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~~25~~ ²⁸. A computer program product according to Claim ~~22~~, further comprising:

computer readable program code which notifies the routing communication protocol stack that the instance of

the plurality of application instances associated with the candidate target communication protocol stack has terminated listening to the port of the single IP address; and

5 computer readable program code which removes the routing table entry corresponding to the candidate target communication protocol stack so as to remove the routing path associated with the IP address, the port and the candidate target communication protocol stack.

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³¹~~30~~. A computer program product according to Claim ~~30~~, wherein the computer readable program code which notifies the routing communication protocol stack that the instance of the plurality of application instances associated with the candidate target communication protocol stack has terminated listening to the port of the single IP address comprises computer readable program code which sends a termination message through a cross coupling facility of the cluster of data processing systems.

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²⁵~~32~~. A computer program product according to Claim ~~32~~, wherein the computer readable program code which establishes a first of the plurality of communication protocol stacks as a routing communication protocol stack associated with the single IP address and the computer readable program code which defines ones of the plurality of communication protocol stacks which are associated with the single IP address comprise means for
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30 incorporating a VIPADISTribute statement in a VIPADynamic definition block associated with the first communication protocol stack, wherein the VIPADISTribute statement defines an IP address as a dynamic routable virtual IP address (VIPA), identifies ports associated with the VIPA

which are routable, and identifies communication protocols stacks associated with the VIPA.

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5 41. A computer program product according to Claim
10 wherein the computer readable program code which
distributes among the plurality of communication protocol
stacks an identification of protocol stacks which are
associated with the single IP address and an
identification of the routing communication protocol
stack comprises computer readable program code which
broadcasts a list including the definitions of the
VIPADISTRIBUTE statement.

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15 42. A computer program product according to Claim
further comprising:

computer readable program code which notifies the
routing communication protocol stack that a connection
utilizing the single IP address and the port of the single
IP address has terminated; and

20 computer readable program code which removes the
routing table entry corresponding to the connection to
the current actual target stack so as to remove the
routing path associated with the IP address, the port and
the current actual target stack.

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25 43. A computer program product according to Claim
32, further comprising computer readable program code
which selects a current actual target stack so as to
provide a selected communication protocol stack
30 associated with the connection request; and

wherein the computer readable program code which
establishes a routing table entry corresponding to the
current actual target stack responsive to receiving a
request to establish a connection to the single IP
35 address and the port so as to define a routing path

associated with the IP address and the port from the
routing communication protocol stack to the current
actual target stack comprises computer readable program
code which establishes a routing table entry
5 corresponding to the selected communication protocol
stack associated with the connection request to provide a
routing path associated with the IP address and the port
from the routing communication protocol stack to the
selected communication protocol stack.

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address and listening to a predefined port of the single IP address in response to distribution by the routing communication protocol stack of an identification of the single IP address and the predefined port as a routable IP address.

15. A system according to Claim 13, wherein the routing communication protocol stack is further configured to incorporate into the current routing table routing paths associated with new connection messages received by the routing communication protocol stack from communication protocol stacks which initiate connections utilizing the single IP address and the predefined port as a source address.

16. A system according to Claim 13, wherein the routing communication protocol stack is further configured to receive requests for connections to the single IP address and the predefined port, select communication protocol stacks for the connections from the destination port table and update the current routing table with path information associated with the connections and the selected communication protocol stacks.

17. A system according to Claim 13, wherein the routing communication protocol stack is further configured to receive connection termination messages from communication protocol stacks which detect termination of connections utilizing the single IP address and predefined port and to update the current routing table to remove routing paths associated with the terminated connections.